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Coral Records of Low Frequency South Pacific Convergence Zone Variability

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Abstract: Decadal and century-scale variability of the Intertropical Convergence Zone (ITCZ) over the different ocean basins and continents has been documented by several studies (e.g., Linsley et al., 1994; Haug et al., 2001; Hodell et al., 2005; Sachs et al., 2009, Oppo et al., 2009) but is poorly understood. The recent results of Sachs et al. (2009) are particularly important since they confirm that over the open Pacific the mean position of the ITCZ was 500km south (~5° south) of its present position during the Little Ice Age (LIA). In the western Pacific, the South Pacific Convergence Zone (SPCZ) extends from the Warm Pool southeast to about 25°-30°S. Although the SPCZ is the largest spur of the global ITCZ, its origin and low frequency variability remains controversial (Takahashi and Battisti, 2007b). Using coral δ18O time-series generated from Fiji, Tonga and Rarotonga on the southwestern side of the SPCZ, we have interpreted secular trends in coral δ18O to lower values in the 20th century as evidence that salinity has been dropping and surface water warming, both indicating that the SPCZ has been expanding southeast since the end of the LIA in the late 1800s (Linsley et al., 2006). This hypothesis is consistent with the Sachs et al. (2009) results for the ITCZ and suggests that during the end of the LIA, both the ITCZ and the SPCZ were equatorward of their present mean positions
We hypothesize that the 25-35 year lag in the initiation of the trend toward lower δ18O in the late 1800s at Tonga (relative to the start of the δ18O trend at Fiji) is the result of the expanding SPCZ footprint as the salinity front on the edge of the SPCZ shifted southeast. To test this hypothesis we propose to analyze δ18O and Sr/Ca on subseasonal resolution samples in coral cores collected in 2004 from Vanua Baluva at 178°56'W in far eastern Fiji in between the main Fiji Islands at 179°E and Tonga at 174°W. These new δ18O and Sr/Ca records from Vanua Baluva will allow us to evaluate the climatic significance of secular trends in both tracers in this region. If the timing of the δ18O trend at Vanua Baluva is intermediate between that observed in Fiji and Tonga this would support our hypothesis for SPCZ expansion.